

B.E. Instrumentation Engineering (CBCS Pattern) Sem-IV
4BEIE03 : Industrial Instrumentation

P. Pages : 2

Time : Three Hours



GUG/S/19/11956

Max. Marks : 80

- Notes :
1. Same Answer book must be used for all question.
 2. All questions carry marks as indicated.
 3. Due credit will be given to neatness and adequate dimensions.
 4. Assume suitable data wherever necessary.
 5. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) Describe the working principle and construction of thermocouples. Describe the different type of compensations used and also the methods of measurement of their output voltage. **8**
- b) A thermocouple circuit uses as chromel-alumel thermocouple which gives an emf of 33.3V when measuring a temperature of 800°C with reference temperature 0°C. The resistance of the meter coil, R_m is 50Ω and a current of 0.1mA gives full scale deflection. The resistance of junctions and leads, R_e is 12Ω. Calculate :
- i) Resistance of the series resistance if a temperature of 800°C is to give full scale deflection.
 - ii) The approximate error due to rise of 1Ω in R_e .

OR

2. a) State laws of thermoelectricity. Draw and explain how the temperature compensation is achieved in case of thermocouple when reference junction is at different temperature than 0°C. **8**
- b) For a certain thermistor $\beta=3140k$ and the resistance at 27°C is known to be 1050Ω. The thermistor is used for temperature measurement and the resistance measured is an 2330. Find the measured temperature. **8**
3. a) Explain construction and working of Bellows element. How do you measure differential and absolute pressure by using it. **8**
- b) A flat circular diaphragm of mild steel has a diameter of 15mm. For mild steel, Young's modulus = 200 GN/m² and Poissons ratio $\nu = 0.28$. Find the thickness of the diaphragm if the maximum stress is not to exceed 300 MN/m² when the applied pressure is 300kN / m². Find the deflection at the centre for a pressure kN / m². Also calculate natural frequency of the diaphragm if the density of mild steel is 8900kg / m³. **8**

OR

4. a) What is manometer? Derive its equation. Show that the sensitivity of manometer increases by using inclined tube manometer. **8**
- b) Draw and explain the set-up for calibration of pressure gauge using dead weight tester. **8**

5. a) Explain construction and working of ultrasonic flow meter. 8
- b) A pitot tube is used for measurement of velocity of flow of water having a density of 1000kg/m^3 . 8
- i) Determine the velocity of flow at the head of the pitot tube if it produces a differential pressure of 10kN/m^2 between its two outlets.
- ii) The same differential pressure is obtained in air at an altitude where the density of air is 0.65kg/m^3 . Determine the velocity of air flow.

OR

6. a) State the principle of operation of an orifice flow meter. Discuss the construction of different kinds of orifice plates and their respective uses. What are the disadvantages of orifice plates. 8
- b) Describe construction and working of v-notch open channel flow meter. 8
7. a) Explain the air bubbles technique for level measurement with suitable diagram. 8
- b) Explain principle, construction and working of radioactive level sensor. Give advantages & limitations. 8

OR

8. a) What is the principle behind displacer type level sensor? Explain the working of the meter along with torque tube unit. 8
- b) Explain ultrasonic liquid level measurement method with suitable diagram. 8
9. a) Define relative humidity? Explain the resistive hygrometer with suitable diagram. 8
- b) Describe the working principle of psychrometer used for humidity measurement with sketch. 8

OR

10. a) Explain infrared absorption humidity sensor in detail. 8
- b) What is pH? Explain one method of pH measurement. 8
